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Gadow's explanation that the likeness of the two forms is the result of parallism in evolution.

The ancestors in the two cases, generalized rails capable of flight, were probably of different genera, or, at least, of different species.

A second paper (Sept., 1896) gives the osteology of *Palæolimnas chathamensis* and *Nesolimnas* (gen. nov.) *dieffenbachii*.

The proportions of *Palæolimnas*, together with the considerable size of the sternal keel and the deep impression of the insertion of the *Pectoralis major* on the crest of the humerus leads the author to state that "it seems probable that *Palæolimnas* may have still been capable of heavy flight for short distances."

Of *Nesolimnas*, the new genus, Mr. Andrews remarks as follows:

"In *Nesolimnas* we have an annectant form linking the flying to the flightless rails. In its plumage, in the condition of its sternum, and in many other points, it reminds us of *Hyopotænidia*; while on the other hand, in the reduction of its wings and the consequent modification of its hind limb it approaches *Ocydromus*. The existence of such an intermediate type seems to give strong support to the opinion that the *Ocydromine* rails have originated from forms capable of flight at a comparatively recent date and in the islands they now inhabit."

Both papers are profusely illustrated.

BOTANY.¹

Climatic Influence of Lake Erie on Vegetation.—In a small district in northern Ohio, including Erie County, Sandusky Bay and the peninsula that bounds it on the north, with the islands of the Put-in-Bay group, there are growing wild 103 species and varieties of phanerogams, which so far as known have not been found anywhere in Michigan, 118 not found in Canada, and 233 not within fifty miles of the city of Buffalo, at the east end of the lake.

Lake Erie is not a barrier to the dispersal of seeds, but it affects differently the climate of places on its different sides, making each different from the others and different from that of places lying in the same latitude, but not near the lake. The south shore is protected from north winds, and receives the full benefit of those from the opposite direction,

¹ Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

while it is the reverse with places on the north side; but why such a great difference in the vegetation at the east and west ends? Is it not due to something else than climate? Let us see. At Buffalo the mean temperature in summer is about four degrees lower than at Sandusky. In the spring months the difference is even greater, being five degrees in April and nearly five in May and in June. The prevailing winds are from the southwest, and traverse the lake for nearly its whole length before reaching Buffalo, keeping it cool in summer, the temperature not having exceeded 92° since the establishment of the weather bureau there twenty-six years ago. Moreover, at the opening of spring the wind takes the ice with it to the east end of the lake, where it remains so crowded as to prevent navigation three weeks or more after Sandusky Bay is clear. The average date of the last killing frost in spring at Sandusky is April 30th, at Buffalo, May 20th. Moreover, Buffalo is not, like Sandusky, so situated as to be protected from cold northwest winds in autumn. Its first killing frost comes on an average September 15th; but at Sandusky it is not until October 24th—thirty-nine days later. The summer at Buffalo, counting the time between the average dates of killing frost, is about two months shorter than at Sandusky—118 days at Buffalo, 177 at Sandusky.

The fact that a number of plants belonging to the Sandusky flora have been found nowhere in Canada, except on the southernmost points, viz., Pt. Peleé Island and Pt. Peleé, which must enjoy nearly as much immunity from frost in spring and autumn as the United States shore immediately to the south of them, implies that the climate elsewhere is too severe for them, and probably for most of the 118 Sandusky plant that are not known to grow in Canada at all. The influence of the climate is further shown by the fact that besides 103 species which have not been found in Michigan at all the Sandusky flora includes a number that have been found only in the southern and especially the southwestern part, where Lake Michigan affords them some protection from frost.

It is interesting to observe that the protection from frost afforded by Lake Erie scarcely extends beyond the counties that border upon it, and as a result we have many plants in these that have not been reported from any other county north of the middle of the State, and quite a number that have been found nowhere else in Ohio except in the southern part, within forty miles of the Ohio River. Even so far south as Columbus the first killing frost in autumn occurs on an average six days earlier than at Sandusky.

When Lake Erie subsided after the melting of the glacier, and Marblehead emerged from the water, it was left bald, so to speak, for whatever deposit the glacier may have left upon it was washed off from most of it by the lake. The same was true of portions of Kelley's Island and Put-in-Bay, and here, where one would expect to find a moist climate, the scant soil formed by disintegration of the limestone becomes more parched under the summer sun than any spot in Ohio farther east. I doubt if another place could be found in the country as far east where there are so many plants that belong to the western plains as on Marblehead.

Having shown that the conditions of climate and soil near the southwestern extremity of Lake Erie are peculiarly suited to southern and western plants, it remains to indicate briefly how the seed succeeded in getting so many miles away from home, though the problem is no more difficult than accounting for the dispersal of any rare plant that is found only at widely separated stations. The seeds of the Compositæ, which are the best represented of all, might many of them have come on the wings of the wind, and so with *Asclepias* and others. The seeds of *Ammania coccinea* and *Rotala ramosior* may have stuck to the feet of a heron while it flew from some southern river bank. *Desmodium illinoense*, *Desmodium sessilifolium* and some others may have been brought by cattle, which, before the time of railroads, were driven from Illinois east by way of Marblehead and Cedar Point, being made to swim across the channel that connects Sandusky Bay with the lake. At an earlier day, when the bison roamed as far east as Lake Erie, seeds of various kinds must have clung to its hair. Others, probably came with the Indians, who seem to have been attracted by the good fishing in this region. Few, if any, are such as have fruit whose seeds are dropped by birds. Fruit-eating birds in migrating would carry northward only those whose fruit survives the winter.

Following is a list of plants which, on the south shore of Lake Erie, I believe occur farther north than anywhere else in this part of the country. Some of them in the west, where the summer isotherms bend to the north, extend to southern Minnesota. As a number of these are both southern and western in distribution, I include in the same list some that appear to reach their eastern limit near Sandusky. Only a few of either the southern or western species extend east along the lake as far as Cleveland. Quite a number, I believe, have not hitherto been recorded as occurring as far north by one hundred and fifty miles, or so far east by a still greater distance.

Viola pedatifida, *Desmodium sessilifolium*, *D. illinoense*, *Baptisia leucantha*, *Psoralea melilotoides*, *Petalostemon candidus*, *P. violaceus*, *Ammania coccinea*, *Rotala ramosior*, *Spiræa lobata*, *Eryngium yuccæfolium*, *Thaspium aureum trifoliatum*, *T. bardinode angustifolium*, *Actinella acaulis glabra*, *Aster shortii*, *Boltonia asteroides*, *Eclepta alba*, *Helianthus grosseserratus*, *H. hirsutus*, *H. mollis*, *H. occidentalis*, *Eupatorium altissimum*, *Kuhnia eupatorioides*, *Liatris squarrosa*, *Solidago rupestris*, *Asclepias sullivantii*, *Phacelia purshii*, *Cuscuta decora*, *Conobia multifida*, *Gerardia auriculata*, *Seymeria macrophylla*, *Lippia lanceolata*, *Euphorbia dentata*, *Populus heterophylla*, *Smilax bona-nox*, *S. ecirrhata*, *Juncus scirpoides*, *Carex conjuncta*, *C. shortiana*, *Poa brevifolia*, *Equisetum levigatum*.—E. L. MOSELEY, Sandusky, Ohio.

The Systematic Arrangement of the Protophyta.—In a recent study of the families and genera of the Protophyta I have reached some results which involve a rearrangement of the group, the general outlines only of which may be given here. It is, of course, here as elsewhere, a matter of individual judgment as to the value to be assigned to any structure in determining the place which a particular plant must occupy in a system, and it is doubly difficult when we are dealing with such minute and simple structures as the protophytes. Moreover, it is quite probable that some of the forms now thought to be distinct are only stages of others also given specific or generic standing. Nevertheless, we have here a great mass of organisms with sufficient autonomy to demand classification at our hands, and we may not excuse ourselves from this task merely because we do not know fully the life history of every species.

The following provisional arrangement has therefore been made as a result of a careful study of the whole problem. As will be observed, I have not considered the hysterozytic habit of some of the forms as entitling them to be separated widely from those to which they are structurally similar. In other words, the "Bacteria" are here not regarded as constituting a distinct family. Furthermore, it appears that "Bacteria" have arisen at various points in the protophyte system, so that it is now impossible to maintain a compact group of the hysterozytic genera. Indeed, it is highly probable that we should admit into some genera both holophytic (green) and hysterozytic (colorless) species, as, for example, the species of *Schizothrix*.

In the arrangement below, the hysterozytes are preceded by a star (*), so that the position of the "Bacteria" may be noticed at a glance.

ORDER I.—CYSTIPHORÆ.

Plants one-celled or associated in loose groups in a gelatinous matrix.

Family 1.—*Chroococcaceæ*.—Our genera may be disposed as follows:

- A. Cells globose, dividing irregularly in three planes. *Chroococcus*, *Glœocapsa*, *Aphanocapsa*, *Microcystis*, *Polycystis*, *Anacystis*, *Gomphosphæria*, *Cœlophærium*, *Clathrocystis*.
- B. Cells globose, dividing regularly in two or three planes. *Merismopedia*, **Sarcina*.
- C. Cells cylindrical, dividing in one plane only. *Synechococcus*, *Glœo-theca*, *Aphanotheca*.

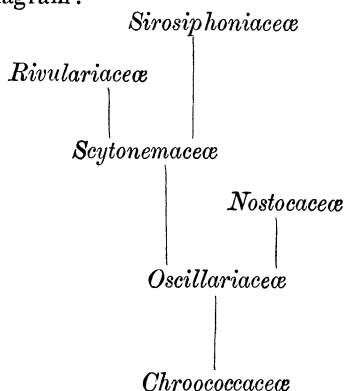
ORDER II.—NEMATOGENEÆ.

Plants several- to many-celled by division mainly in one plane, forming simple or branched filaments; cell-walls often thickish, and separating an outer continuous layer as a sheath, which encloses the row of cells.

Five families may be distinguished as follows:

- A. Cells in each filament alike; no heterocysts. Filaments cylindrical, motile, *Oscillariaceæ*.
- B. Cells differentiated; heterocysts present.
 - a.* Division of cells in one plane only.
 - 1. Filaments moniliform, unbranched, *Nostocaceæ*.
 - 2. Filaments cylindrical, sometimes spuriously branched, *Scytonemaceæ*.
 - 3. Filaments tapering, sometimes spuriously branched, *Rivulariaceæ*.
 - b.* Division of cells ultimately in three planes. Filaments with true branches, *Sirosiphoniaceæ*.

The relationship of these families to each other may be indicated by the following diagram:



The arrangement of our genera within the families may be as follows :

Family 2.—*Oscillariaceæ*.

- A. Cells green or greenish ; usually two or more filaments in each sheath ; *Schizothrix*, *Porphyrosiphon*, *Hydrocoleum*, *Dasyglœa*, *Microcoleus*.
- B. Cells green or greenish ; filaments solitary in the sheaths, or sheathless ; *Plectonema*, *Symploca*, *Lyngbya*, *Phormidium*, *Oscillaria*, *Arthrospira*, *Spirulina*.
- C. Cells colorless ; filaments without sheaths, or nearly so ; **Leptotrichia*, **Beggiatoa*, **Bacillus*, **Pasteurella*, **Clostridium*, **Cornilia*, **Vibrio*, **Spirillum*, **Pacinia*, **Bacterium*. This series is parallel to B, and perhaps may eventually be merged into it. Certainly *Spirulina* and *Spirillum* are closely related, if, indeed, they are not identical.

Family 3.—*Nostocaceæ*.—*Nostoc*, **Leuconostoc*, **Staphylococcus*, **Micrococcus*, *Wollea*, *Anabæna*, **Streptococcus*, *Aphanizomenon*, *Nodularia*, *Cylindrospermum*.

Family 4.—*Scytonemaceæ*.—*Microchæte*, *Scytonema*, *Hassellia*, *Tolyptothrix*, *Desmonema*.

Family 5.—*Rivulariaceæ*.—*Calothrix*, *Dichothrix*, *Polythrix*, *Isactis*, *Rivularia*, *Glœotrichia*, *Brachytrichia*.

Family 6.—*Sirosiphoniaceæ*.—*Haplosiphon*, *Stigonema*.

It will be observed that the "Bacteria" are confined to the first, second and third families, by far the greater number occurring in the *Oscillariaceæ*.

The "Slime Moulds" (*Mycetozoa*) are not here regarded as proto-phytes. These interesting and often very beautiful organisms I am reluctantly compelled to consider as falling outside of the dominion of Botany ; and much as I dislike to do so, I am assured that we must surrender their study in the future to our zoological friends.—CHARLES E. BESSEY.